

PATENT ABSTRACTS OF JAPAN

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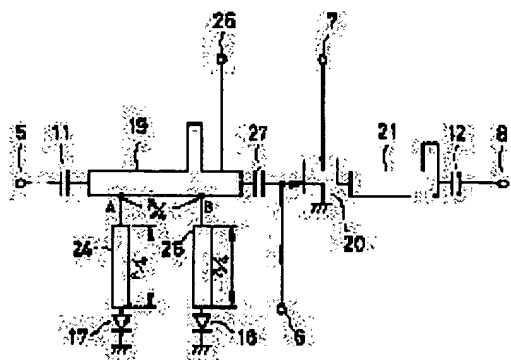
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(54) AMPLIFIER WITH RF SWITCH FUNCTION

(57)Abstract:

PURPOSE: To reduce the size and weight of an amplifier without independently preparing a PIN diode attenuator for turning on/off an RF input to an RF low noise amplifier.

CONSTITUTION: Two pairs of series circuits consisting of PIN diodes 17, 18 and $1/4$ wavelength lines 24, 25 are connected between the signal line of an input matching circuit in an FET to be an amplifier element and earth and an ON/OFF control signal for the diodes 17, 18 is supplied from a control terminal 26. When the diodes 17, 18 are ON, the lines 24, 25 are functioned as high impedance and vice versa, so that an RF input signal can be efficiently turned on/off.



LEGAL STATUS

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] Especially this invention relates to the amplifier with RF switch function which was made to decrease the input RF signal in a PIN diode about amplifier with RF switch function.

[0002]

[Description of the Prior Art] Conventionally, the example of the low noise RF amplifier which used the PIN diode as an attenuation component is indicated by JP,3-58030,U, and the example of a circuit is shown in drawing 2. In the PIN diode attenuator 22, the RF signal from an input terminal 1 is inputted into the attenuation circuit of PIN diodes 17 and 18 through a hybrid circuit 15, and is further drawn through a hybrid circuit 16 to an output terminal 4.

[0003] The control terminals 2 and 3 are formed for PIN diodes 17, such as this, and control of 18, and magnitude-of-attenuation control of PIN diodes 17 and 18 is made by supplying a current respectively through resistance 13 and 14 from the control terminals 2 and 3, such as this. In addition, 9 and 10 are coupling capacitors.

[0004] In a low noise amplifier 23, the RF signal from the output terminal 4 of the PIN diode attenuator 22 is supplied to an input terminal 5, and is impressed through the input matching circuit 19 at the gate of FET20 which is an amplifier. The magnification output by this FET20 is taken out from a drain, and is drawn through the output matching circuit 21 to an output terminal 8.

[0005] In addition, as for a gate bias terminal and 7, a drain bias terminal, and 11 and 12 is [6] coupling capacitors.

[0006] In this configuration, the resistance over the microwave which is the RF signal of PIN diodes 17 and 18 changes continuously from infinity to zero mostly according to the current value supplied from the control terminals 2 and 3. By this resistance value change, the magnitude of attenuation of microwave power changes and it becomes variable attenuator. Therefore, even if an excessive microwave signal is impressed by supplying a current to the control terminals 2 and 3 to the input terminal 1 of the PIN diode attenuator 22, in the output terminal 4 of the PIN diode attenuator 22, it becomes the signal of a low and breakage of FET20 for low noise magnification can be prevented.

[0007]

[Problem(s) to be Solved by the Invention] In such a conventional circuit, since the PIN diode attenuator and the low noise amplifier are formed as a circuit according to individual, the whole circuit scale needs to become large, and it is necessary to adjust an attenuator and amplifier according to an individual, and there is a problem that it is complicated and adjustment time amount also becomes long.

[0008] Furthermore, in a PIN diode attenuator, there is also a problem of yes, becoming the cause of it being set to 1.5-2dB in a use band, and degrading the noise figure of a low noise amplifier greatly if two Brit circuits are used and passage loss of this etc. and the dead loss of a PIN diode are doubled.

[0009]

[Means for Solving the Problem] Amplifier with RF switch function characterized by to include the series-connection circuit of the track and the PIN diode which are prepared between an input matching

circuit, the amplifier which amplifies the output of this input matching circuit, the output matching circuit which considers this magnification output as an input, and the signal line of said input matching circuit and a reference potential point, and have one fourth of the die length of input RF signal wave length, and the supply terminal of a bias current to said PIN diode according to this invention.

[0010] Furthermore, said series connection circuit is established in two-piece juxtaposition, and the amplifier with RF switch function characterized by setting spacing of two series connection circuits, such as this, as one fourth of the die length of said input RF signal wave length is obtained.

[0011]

[Function] A PIN diode attenuator can be incorporated by adding the PIN diode attenuator constituted from a PIN diode by a part of input matching circuit of a low noise amplifier, without degrading the function of the input matching circuit of FET.

[0012]

[Example] Below, the example of this invention is explained with reference to a drawing.

[0013] Drawing 1 is the circuit diagram of the example of this invention, and the same sign shows drawing 2 and an equivalent part. The RF signal from an input terminal 5 is supplied to the input matching circuit 19 through the capacitor 11 for direct-current components, and the output of this input matching circuit 19 is minded capacitor 27 for DC blocking, and is supplied to the gate of FET20 which is an amplifier.

[0014] The magnification output by this FET20 is taken out from a drain, and is further drawn through the capacitor 12 for DC blocking through the output matching circuit 21 to an output terminal 8. In addition, 6 and 7 show the gate and each bias terminal of a drain, respectively.

[0015] Between two parts A and B on the signal line of the input matching circuit 19, and earth lines, the $\lambda/4$ -wave tracks (λ shows the wavelength of a RF signal) 24 and 25 and the series circuit of PIN diodes 17 and 18 are prepared, respectively. And the distance during the nodes A and B with the input matching circuit 19 of series circuits, such as this, is set as die length equal to $\lambda/4$ wave. The control terminal 26 is an on-off control terminal of PIN diodes 17 and 18.

[0016] In not making RF input signal into **, by supplying predetermined bias to the bias terminal 7, and supplying a current from the control terminal 26, FET20 is set to ON and it also sets PIN diodes 17 and 18 to ON. Since PIN diodes 17 and 18 are ON and both the tips of the $\lambda/4$ -wave tracks 17 and 18 are considered as a ground, the impedance which saw the PIN diode side turns into high impedance from Points A and B. Therefore, the RF signal from an input terminal 1 is supplied to the gate of FET20, without receiving attenuation.

[0017] In making RF input signal into **, by supplying neither an electrical potential difference nor a current to the bias terminal 7 and the control terminal 26, respectively, FET20 is made off and it also makes PIN diodes 17 and 18 off. Since PIN diodes 17 and 18 are off and both the tips of the $\lambda/4$ -wave tracks 24 and 25 are released, the impedance which saw the PIN diode side turns into a low impedance from Points A and B. Therefore, the RF signal from an input terminal 1 is no longer supplied to the gate of FET20 in response to attenuation.

[0018] It became possible to make the magnitude of attenuation into max by setting especially the distance of Points A and B as $\lambda/4$, and, therefore, it became possible to obtain the twice as many magnitude of attenuation as this as compared with the example of conventional drawing 2.

[0019] In addition, in the above-mentioned example, although the series circuit of a $\lambda/4$ -wave track and a PIN diode is established in two-piece juxtaposition, even if it prepares only between Point A and ground rye and performs the same control as the above, equivalent effectiveness is acquired.

[0020]

[Effect of the Invention] Thus, since the attenuator which used the PIN diode and the $\lambda/4$ -wave track for the input matching circuit was added according to this invention, while functional deteriorating [of an input matching circuit] a miniaturization and lightweight-ization becomes that there is nothing possible, it is effective in high isolation and low loss becoming possible.

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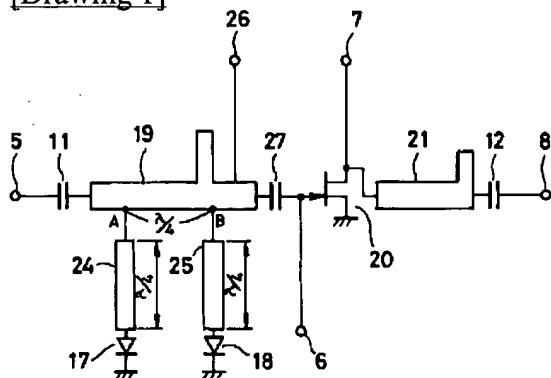
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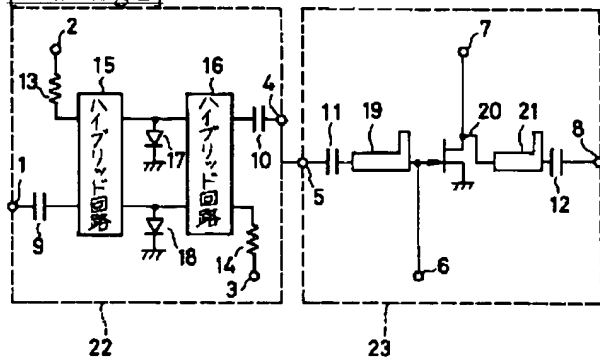
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DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]